Laws and Regulations Committee
Interim Report

Joe Benavides, Chairman
Texas Weights and Measures

Reference
Key Number

200 INTRODUCTION

The Committee on Laws and Regulations (hereinafter referred to as "Committee") submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting in Jacksonville, Florida, January 22 - 25, 2006.

Table A identifies the agenda items in the Report by Reference Key Number, Item Title, and Page Number. The item numbers are those assigned in the Interim Meeting Agenda. A voting item is indicated with a "**V**" after the item number. An item marked with an "**I**" after the reference key number is an information item. An item marked with a "**D**" after the key number is a developing item. The developing designation indicates an item has merit; however, the item is returned to the submitter for further development before any action can be taken at the national level. An item marked with a "**W**" was withdrawn by the Committee. An item marked with a "**W**" generally will be referred to the regional weights and measures associations because it either needs additional development, analysis, and input or does not have sufficient Committee support to bring it before the NCWM.

This Report contains many recommendations to revise or amend National Institute of Standards and Technology (NIST) 130 (HB-130), 2006 Edition, "Uniform Laws and Regulations" and/or Handbook 133 (HB-133), 2005 Edition, "Checking the Net Contents of Packaged Goods." Proposed revisions to the handbook(s) are shown in **bold face print** by ~~**striking out**~~ information to be deleted and **underlining** information to be added. "SI" means the International System of Units. "FPLA" means the Fair Packaging and Labeling Act. The section mark, "§," is used in most references in the text and is followed by the section number and title, (for example, § 1.2. Weight). When used in this report, the term "weight" means "mass."

Note: The policy of NIST is to use metric units of measurement in all of its publications; however, recommendations received by the NCWM technical committees have been printed in this publication as they were submitted and may, therefore, contain references to inch-pound units.

Subject Series

Table A
Index to Reference Key Items

Table B
Appendices

Details of all Items
(In order by Reference Key Number)

232 METHOD OF SALE REGULATION

232-1 I Temperature Compensation for Petroleum Products

Source: Southern Weights and Measures Association (SWMA). (See item 232-4 in the Report of the 89th NCWM Annual Meeting in 2004.)

Recommendation: Amend the Method of Sale Regulation in Handbook 130 by adding the following:

2.20.X. Refined Petroleum Products

2.20.X.A. -- Where not in conflict with other statutes or regulations, refined petroleum products delivered through: (1) vehicle tank meters, (2) loading rack meters, and (3) stationary meters with flow rates of 115 L (30 gal) or more per minute *may* be sold with the volume adjusted to compensate for temperature. When petroleum products are sold temperature compensated:

(a) All sales shall be in terms of liters or U.S. gallons at 15 °C (60 °F);

(b) The temperature compensation shall be accomplished through automatic means;

(c) The primary indicating elements, recording elements, and all recorded representations (receipts, invoices, bills of lading, etc.) shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F);

(d) For vehicle tank meters, all sales by the same person or company for the same metering application within the same state shall be sold temperature compensated in 12-month increments. For example, a company may not choose to operate some vehicle tank meters with automatic temperature compensators and others without. Nor may a company choose to engage the automatic temperature compensator on a device only during certain times of the year.

(e) For loading rack meters and stationary meters with flow rates of 115 L (30 gal) or more per minute, all sales by the same person or company for the same metering application at the same location shall be sold temperature compensated in 12-month increments. For example, a company may not choose to operate some loading rack meters with automatic temperature compensators and others without. Nor may a company choose to engage the automatic temperature compensator on a device only during certain times of the year.

2.20.X.B. -- Where not in conflict with other statutes or regulations, petroleum products delivered through meters other than those specified in section 2.20.X.A. shall be sold *without* the volume adjusted to compensate for temperature.

Note 1: As defined in the Handbook 130 Engine Fuels, Petroleum Products, and Automotive Lubricants Inspection Law, refined petroleum products are products obtained from distilling and processing of petroleum (crude oil), unfinished oils, recycled oils, natural gas liquids, refinery blend stocks, and other miscellaneous hydrocarbon compounds.

Note 2: Paragraphs 2.20.X.A.(d) and (e) shall only be effective as long as temperature-compensated sales remain permissive in at least some relevant applications. If temperature compensation becomes mandatory for all relevant applications, then this paragraph shall be removed.

Discussion: Selling fuel adjusted to the volume at 15 °C (60 °F) throughout the distribution system is the most equitable way fuel can be sold without the buyer or seller gaining a competitive advantage.

This item is considered in conjunction with a temperature compensation item that is before the Specifications and Tolerances (S&T) Committee, Item 331-3, although the S&T Committee's item is limited to vehicle-tank meters.

A similar proposal was made by the Northeast Weights and Measures Association (NEWMA) in 2000 that mirrored a temperature compensation item before the S&T Committee at that time. NEWMA noted that Pennsylvania, New Hampshire, Maine, and Canada permit temperature compensation in sales of products like home heating fuel and retail gasoline. In 2001 the Committee withdrew this item after hearing testimony from several jurisdictions that opposed it.

The Committee has heard numerous comments in support of, and a few comments in opposition to, temperature-compensated sales of petroleum fuels. While most comments were generally supportive of the idea of temperature-compensated sales, the Committee did receive comments from a couple of jurisdictions that were concerned about the additional inspection time and resources that will be needed to test devices equipped with temperature compensators. The Committee also received a recommendation from NEWMA to withdraw this item.

Among the comments received in support of temperature-compensated sales, there was a fair amount of disagreement about how this should be accomplished. Most of the discussion fell into one of three broad categories: (1) If temperature-compensated sales are allowed, what should they look like? (2) In which metering applications should temperature-compensated sales be allowed? (3) Should temperature-compensated sales be permissive or mandatory?

<u>What should temperature-compensated sales look like?</u>
The Committee heard from the Western Weights and Measures Association (WWMA), the Central Weights and Measures Association (CWMA), and the Southern Weights and Measures Association (SWMA) that temperature-compensated sales needed to have certain parameters established so that all sales conducted in this manner are comparable. All three regions agreed that (1) temperature-compensated sales should be adjusted to the volume at 15 °C (60 °F), (2) temperature compensation should be accomplished through automatic means, (3) indicating and recording elements and all written representations should indicate that the volume delivered is temperature compensated, and (4) all sales by the same person/company for the same metering application within the same jurisdiction must be sold either compensated or uncompensated for full calendar years.

The Committee adopted these criteria into its recommendation.

<u>In which metering applications should temperature-compensated sales be allowed?</u>
The Committee heard from the WWMA and the SWMA that temperature-compensated sales should be allowed in all metering applications through meters with flow rates of 20 gal or more per minute. The flow rate of 20 gal per minute was selected because it was believed this would effectively allow temperature-compensated sales in all applications except for standard retail motor-fuel devices. Both regions thought that temperature-compensated sales should be prohibited through standard retail motor-fuel devices.

The Committee heard from the CWMA that temperature-compensated sales should be limited to sales through vehicle tank meters, loading rack meters, and retail motor-fuel devices used exclusively for fueling trucks in sales of 100 gallons or more. The CWMA was concerned that allowing temperature-compensated sales in all metering applications except standard retail motor-fuel devices was overly broad. The CWMA was more comfortable with listing specific applications where temperature-compensated sales would be allowed and wanted it made clear that temperature-compensated sales would be prohibited through standard retail motor-fuel devices. The CWMA submitted the following language for the Committee's consideration:

> <u>2.X.X. – Wholesale refined petroleum product sales, sales of diesel fuel for truck refueling, and bulk sales of refined petroleum products of 100 gal or more may be dispensed through a</u>

meter that automatically compensates for the temperature to represent a gallon as 231 cubic inches at 60 °F.

2.XX.1. – Implementation: Wholesalers and retailers that implement temperature compensation for wholesale sales, devices used exclusively for diesel fuel for truck refueling, or bulk sales of refined petroleum products of 100 gal or more shall implement this practice for all meters or dispensers at such location.

2.XX.2. – Temperature compensation disclosure: All meters or dispensers which employ temperature compensation shall be labeled on the meter or dispenser, and the printed representation must state that the volume represented has been corrected to 60 °F.

Note 1. Refined petroleum products are derived from crude oils through processes such as catalytic cracking and fractional distillation.

Note 2. Diesel fuel means a refined middle distillant suitable for use as a fuel in a compression-ignition engine (diesel) internal combustion engine.

The Committee's recommendation constitutes a compromise. The Committee agreed with the CWMA that the most prudent approach to temperature-compensated sales was to limit them to specific metering applications where almost everyone would be comfortable with its use. The Committee preferred the approach of the WWMA and the SWMA when defining retail motor-fuel devices used exclusively for fueling trucks and opted to define these devices based upon the meter flow rate rather than the delivery quantity. The Committee selected a flow rate of 115 L (30 gal) to be consistent with the thresholds in the LMD code in Handbook 44. Section S.4.4. and Table T.2. of the LMD code specify the minimum flow rate of large-capacity metering devices as 115 L (30 gal) per minute. Finally, the Committee included language in the recommendation that makes it clear that, where not expressly permitted, temperature-compensated sales are prohibited.

Should temperature-compensated sales be permissive or mandatory?

The Committee heard from the WWMA and the SWMA that temperature-compensated sales should be implemented on a permissive basis, but that future mandatory dates should be established. Those who support a mandatory requirement believe that in the long run a permissive requirement will cause confusion within the marketplace and hinder the consumer's ability to make value comparisons between companies that sell products compensated and those that don't. Particularly with regard to home heating fuel sales, jurisdictions are concerned customers will not be told whether the price per gallon they are being quoted prior to the sale is compensated or uncompensated (even if it is disclosed on the invoice they receive after the delivery). In addition, even if consumers are informed that a product quote is for a temperature-compensated delivery, consumers won't know what it means and won't be able to make a meaningful comparison between quotes for compensated and uncompensated products. The WWMA and SWMA recommended that future mandatory dates be established based on a reasonable timetable for each type of metering application that takes into consideration equipment replacement costs and existing device life-expectancy. NIST suggested, as an alternative, that mandatory dates for each type of metering application be established initially for new installations and that later dates be established for existing devices.

The Committee heard from the CWMA that temperature-compensated sales should be implemented on a purely permissive basis. The CWMA opposes the inclusion of any future mandatory dates at this time. The CWMA believes that temperature-compensated sales should be market-driven and that suppliers will make sales on a temperature-compensated basis when consumers demand it and should not be required to do so before then. Many jurisdictions believe that the imposition of a mandatory requirement is too burdensome on the industry, requiring upgrades and possibly the replacement of many meters without adequate justification.

The Committee agreed that the inclusion of mandatory dates during the initial implementation of this item was too controversial and would elicit too much opposition. The Committee felt it was important to get some form of regulation regarding temperature-compensated sales of petroleum adopted into Handbook 130 and thought that as many barriers as possible should be removed in order to achieve this goal. Although the Committee's recommendation reflects a purely

permissive requirement for temperature-compensated sales, the Committee may be willing to consider establishing future mandatory dates if a need is demonstrated after this permissive regulation is implemented.

232-2 V Biodiesel and Fuel Ethanol Labeling

Source: Central Weights and Measures Association (CWMA)

Recommendation: Add the biodiesel and fuel ethanol labeling requirements that currently appear in the Handbook 130 Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation to the Method of Sale Regulation.

Add the following text to the Method of Sale Regulation in Handbook 130:

2.XX. Biodiesel.

2.XX.1. Identification of Product. – Biodiesel and biodiesel blends shall be identified by the capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel. (Examples: B10; B20; B100)

2.XX.2. Labeling of Retail Dispensers Containing Between 5 % and 20 % Biodiesel. Each retail dispenser of biodiesel blend containing more than 5 % and up to and including 20 % biodiesel shall be labeled with either:

2.XX.2.1. The capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel and ending with 'biodiesel blend.' (Examples: B10 biodiesel blend; B20 biodiesel blend), or;

2.XX.2.2. The phrase 'biodiesel blend between 5 % and 20 %' or similar words.

2.XX.3. Labeling of Retail Dispensers Containing More Than 20 % Biodiesel. – Each retail dispenser of biodiesel or biodiesel blend containing more than 20 % biodiesel shall be labeled with the capital letter B followed by the numerical value representing the volume percentage of biodiesel fuel and ending with either 'biodiesel' or 'biodiesel blend.' (Examples: B100 Biodiesel; B60 Biodiesel Blend)

2.XX.4. Documentation for Dispenser Labeling Purposes. – The retailer shall be provided, at the time of delivery of the fuel, with a declaration of the volume percent biodiesel on an invoice, bill of lading, shipping paper, or other document. This documentation is for dispenser labeling purposes only; it is the responsibility of any potential blender to determine the amount of biodiesel in the diesel fuel prior to blending.

2.XX.5. Exemption. – Biodiesel blends containing 5 % or less biodiesel by volume are exempted from requirements 2.XX.1 through 2.XX.4.

2.YY. Fuel Ethanol.

2.YY.1. How to Identify Fuel Ethanol. – Fuel ethanol shall be identified by the capital letter E followed by the numerical value volume percentage. (Example: E85)

2.YY.2. Retail Dispenser Labeling. – Each retail dispenser of fuel ethanol shall be labeled with the capital letter E followed by the numerical value volume percent denatured ethanol and ending with the word 'ethanol.' (Example: E85 Ethanol)

2.YY.3. Additional Labeling Requirements. – Fuel ethanol shall be labeled with its automotive fuel rating in accordance with 16 CFR Part 306.

Discussion: This proposal does not impose any new requirements. These requirements have already been adopted and are published in the Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation in Handbook 130. This proposal would place duplicate requirements into the Method of Sale Regulation.

Section 2.20. of the Method of Sale Regulation in Handbook 130 currently contains requirements for the disclosure of oxygenates in gasoline blends. Including requirements for the disclosure of biodiesel, biodiesel blends, and fuel ethanol is consistent with this practice and should be required in order to ensure consumers are fully informed when making purchasing decisions.

The Committee has received numerous comments in support of this item. The Committee has also heard from the National Biodiesel Board that they support this item.

250 INTERPRETATIONS AND GUIDELINES

250-1 V Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory

Source: Western Weights and Measures Association (WWMA)

Recommendation: Remove the Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory Guidelines from Handbook 130 and instead post an updated version (see Appendix C) at http://www.nist.gov/owm.

Amend Handbook 130 Interpretations and Guidelines Section 2.6.6. by striking all of the current text and replacing it with the following:

> **2.6.6. Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory**
> **(Developed by the Petroleum Subcommittee)**
>
> **The petroleum fuels and lubricant laboratory is an integral element of an inspection program and is generally developed to satisfy the testing requirements as described in the laws and rules of the regulating agency. Guidelines have been developed to assist States in evaluating their options of employing a private lab or building or expanding their own lab. This information is available at http://www.nist.gov/owm.**

Discussion: Handbook 130 Interpretations and Guidelines Section 2.6.6., Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory, was adopted in 1994. Since that time it has not been updated despite the fact that laboratory equipment and costs change continually. It is believed that posting these guidelines on the Internet will allow for them to be updated in a more expedient manner than what is permitted by the NCWM process. Eliminating the NCWM process from the updating of these guidelines is not believed to be detrimental because the guidelines are informative, not regulatory.

The Committee has received no comments opposing this item. The Committee has also assigned the Petroleum Subcommittee the task of reviewing and updating these guidelines on a biannual basis and providing the Committee with a report of items to be updated.

270 OTHER ITEMS

270-1 D Developing Items

The NCWM established a mechanism to disseminate information about emerging issues which have merit and are of national interest. Developing items have not received sufficient review by all parties affected by the proposals or may be

insufficiently developed to warrant review by the NCWM L&R Committee. The developing items listed are currently under review by at least one regional association, subcommittee, or work group.

The developing items are listed in the following appendices according to the specific NIST Handbook into which they fall:

Appendix A – Handbook 130
Appendix B – Handbook 133

The Committee encourages interested parties to examine the proposals included in the appendices and to send their comments to the contact listed in each part.

The Committee asks that the regional weights and measures associations, subcommittees, and work groups continue their work to fully develop each proposal. Should an association, subcommittee, or work group decide to discontinue work on a developing item, the Committee asks that it be notified. When the status of an item changes because the submitter withdraws the item, the item will be listed in a table below. For more details on items that are moved from the Developing Items list to the Committee's main agenda, refer to the new reference number in the main agenda.

Joe Benavides, Texas, Chairperson
James Cassidy, Cambridge, Massachusetts
Vicky Dempsey, Montgomery County, Ohio
Dennis Johannes, California
Stephen Benjamin, North Carolina

Vince Orr, ConAgra Foods, Associate Membership Committee Representative
Doug Hutchinson, Canada, Technical Advisor
Brian Lemon, Canada, Technical Advisor
Kathryn Dresser, NIST, Technical Advisor
Tom Coleman, NIST, Technical Advisor

Laws and Regulations Committee

Appendix A

Item 270-1: Developing Items – Handbook 130

Part 1 D Premium Diesel Lubricity

Source: Southern Weights and Measures Association (SWMA)

Proposal: Amend Section 2.2.1. in Handbook 130 Uniform Engine Fuels, Petroleum Products, and Automotive Lubricants Regulation as follows:

2.2.1. Premium Diesel Fuel – All diesel fuels identified on retail dispensers, bills of lading, invoices, shipping papers, or other documentation with terms such a premium, super, supreme, plus, or premier must conform to the following requirements:

(a) Cetane Number – A minimum cetane number of 47.0 as determined by ASTM Standard Test Method D 613.

(b) Low Temperature Operability – A cold flow performance measurement which meets the ASTM D 975 tenth percentile minimum ambient air temperature charts and maps by either ASTM Standard Test Method D 2500 (Cloud Point) or ASTM Standard Test Method D 4539 (Low Temperature Flow Test, LTFT). Low temperature operability is only applicable October 1 – March 31 of each year.

(c) Thermal Stability – A minimum reflectance measurement of 80 % as determined by ASTM Standard Test Method D 6468 (180 min, 150 °C).

(d) Lubricity – A maximum wear scar diameter of 520 µm as determined by ASTM D 6079. ~~**If an enforcement jurisdiction's singe test of more than 560 µm is determined, a second test shall be conducted. If the average of the two tests is more than 560 µm, the sample does not conform to the requirements of this part.**~~

Discussion: A member of the petroleum industry believes that the test and associated tolerances for lubricity on premium diesel specified in Section 2.2.1.(d) are inconsistent with that for regular diesel. Effective January 1, 2005, the test tolerance for regular diesel lubricity will be the ASTM D 6079 reproducibility of 136 µm (see ASTM D 975-04b). NCWM has chosen to accept the ASTM reproducibility limits for all diesel (D 975) and gasoline (D 4814) properties (see Section 7.2.2., Reproducibility), but has chosen a different reproducibility limit for premium diesel lubricity without providing any explanation as to why the ASTM reproducibility limit is insufficient. If the NCWM intends to impose a stricter lubricity requirement for premium diesel, it should designate a tighter specification for this property instead of a different test tolerance (e.g., for regular and premium gasoline, premium has a different octane specification than regular but the test tolerance is the same). ASTM reproducibility limits are, by definition, based on establishing a 95 % probability that product that should pass, will pass. Applying an average test as specified in Section 2.2.1.(d) reduces this probability to only 80 %.

The Committee received comments from several members of the Premium Diesel Work Group (Work Group) who do not support the item as presented by the petroleum industry member. Work Group members believed the process that led to the current definition was very thorough and complete and the premium diesel lubricity requirements were established with a full understanding of their implications. The Work Group members felt that knowledgeable individuals provided input to the process, which lead to the consensus position contained in the current regulation. The work being done by the Work Group was reported at meetings of ASTM Subcommittee E-2 every six months. The current regulation has been endorsed by the American Petroleum Institute, the Engine Manufacturer's Association, and the NCWM.

Prior to this requirement being adopted, the ASTM Lubricity Task Force conducted a great deal of research on this topic. Based on their research, the ASTM Lubricity Task Force had concluded that a limit of 520 µm would meet the

requirements of equipment in the field. Since the passage of this model regulation, ASTM included a lubricity requirement for No. 1 and No. 2 diesel fuel effective January 1, 2005. The ASTM requirement is also 520 µm.

Work Group members reported that when this regulation was being written fuels with adequate lubricity provided a functional benefit to the end user. The Work Group agreed with the ASTM Lubricity Task Force that 520 µm was the correct limit to set for premium diesel. However, the Work Group's review process also indicated increased pump wear for fuels with High-Frequency Reciprocating Rig (HFRR) values greater than 560 µm. The current reproducibility value of the HFRR test method would have placed enforcement well beyond the 560 µm level, essentially allowing fuels with little lubricity protection to be sold as Premium. The Work Group believed they could not recommend a premium fuel standard that would permit excessive pump wear. Using the statistical tools provided in ASTM D 3244, the Work Group evaluated an enforcement limit of 560 µm. The statistical tools indicated that a single laboratory reporting the assigned test value would have an enforcement limit of approximately 80 % probability of acceptance, while the average of two separate laboratories reporting the assigned test value would have an enforcement limit of approximately 90 % probability of acceptance. It was agreed that for a premium fuel the average of two test results was the best approach given the current test methods and precision available. Therefore, if a test exceeds 560 µm, then a second test must be run. The average of the two tests must exceed 560 µm before a violation would occur. At this time, the Work Group members believe this remains the best approach.

The Committee has forwarded this proposal to the Petroleum Subcommittee for review and has requested that the Subcommittee provide the Committee with its recommendation. The Subcommittee has requested that this item remain on the Committee's agenda as a developing issue until the Subcommittee can make a recommendation.

Contact: NCWM Petroleum Subcommittee, Ron Hayes, Chair, (573) 751-2922, ron.hayes@mda.mo.gov.

Part 2 D Guidelines for the Method of Sale of Fresh Fruits and Vegetables

Source: Northeast Weights and Measures Association (NEWMA)

Proposal: Amend Handbook 130 Interpretations and Guidelines Section 2.3.2. to recognize and support innovation in modern retail food marketing approaches at all forms of outlets from typical grocery stores to the age-old farm markets.

Discussion: The method of sale guidelines for the sale of fresh fruits and vegetables that currently appear in Handbook 130 are outdated and in need of revision. The present guidelines do not recognize current retailing practices and are not expansive enough to cover many exotic and unusual fruits and vegetables that are becoming more common in the marketplace. Additionally, the present guidelines do not take into consideration the necessary limitations experienced by retailers at road-side stands and farmers markets.

The original proposal for this item reflected input from only a single jurisdiction. The Committee was informed that several industry associations have requested an opportunity to review and respond to this proposal. The Committee believes there are several factual errors within the classifications of produce provided, and there are several types of produce still not covered by the proposal provided. The Committee has made this item developmental so it may be more fully developed with input from jurisdictions throughout the country and from affected industry associations and businesses.

Contact: Ross Andersen, NY Bureau of Weights and Measures, (518) 457-3146, ross.andersen@agmkt.state.ny.us.

Appendix B

Item 270-1: Developing Items – Handbook 133

Part 1 D Moisture Loss

Source: Northeast Weights and Measures Association (NEWMA)

Proposal: Amend Handbook 133 Section 2.3, Moisture Allowances (pages 17 through 19 of the Handbook) to provide clearer guidance.

Discussion: The issue of moisture loss is complex. NIST Handbook 133 currently provides specific guidance on the determination and application of moisture allowances for only a limited number of commodities. Concerns have been raised that this guidance is confusing and difficult to understand, particularly with regard to when moisture loss is applied (i.e., at the time of inspection or subsequent to the inspection). Requests have been received to reword this section to make it easier to understand and apply.

In addition, NIST Handbook 133 provides little guidance on the determination and application of moisture allowances for commodities other than those specifically listed. Weights and measures jurisdictions across the country have been struggling with how to properly handle moisture loss during packaging inspections and need more definite guidance on this issue.

The Committee does not believe it has the time or expertise to properly address the issue of moisture loss within the structure of the NCWM. The Committee has decided to reactivate the Handbook 133 work group to establish more effective and extensive guidance to the NCWM regarding the proper determination and application of moisture loss.

Contact: NIST Handbook 133 WorkGroup. Kathryn Dresser, Technical Advisor, (301) 975-3289, kathryn.dresser@nist.gov, or Tom Coleman, Technical Advisor, (301) 975-4868, t.coleman@nist.gov**.**

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Appendix C

Item 250-1: New (Proposed) Basic Engine Fuels, Petroleum Products, and Lubricants Laboratory Guidelines

Introduction

The petroleum fuels and lubricant laboratory is an integral element of an inspection program and is generally developed to satisfy the testing requirements as described in the laws and rules of the regulating agency. This document outlines the basic facets of such a laboratory and can be used as a model to initiate or upgrade a program. Since a testing program is of little value unless recognized standards and methods are utilized, this description of a model laboratory has been developed under the assumption that recognized ASTM International and SAE International standards and test methods have been incorporated into the laws, rules, and policies of the regulating agency.

This document provides sufficient information to investigate cost associated with the development of a fuels and lubricant laboratory. Information pertaining to facility needs, recommended ASTM test procedures, test equipment, and the number of personnel required for staffing has been included. Hidden costs associated with the unique working environment of laboratories are often overlooked during initial evaluations; therefore sections have also been included dealing with quality assurance, safety, and hazardous materials.

Laboratories may be required to perform additional analysis outside the purview of consumer regulations, e.g., analyses pertaining to environmental regulations or tax fraud investigations. This document will not address those areas specifically; however, information presented here may assist in the determination of general costs and requirements.

State-Operated or Contract

The decision to operate a State testing laboratory, to enter into a contractual agreement with a private testing laboratory, or to have a hybrid of the two depends on a variety of factors: the scope of the program, funding sources, political climate, etc. The question is often asked: "Is there a point at which it is cheaper for a State to operate its own fuels laboratory?" The Motor Fuel Task Force assembled in 1984 concluded that a program testing 6000 samples per year (500 samples per month) is the minimum level to justify building and equipping a fuel laboratory.

Consideration must be given to the time required for the laboratory to complete the analyses. The value of any inspection program is diminished if laboratory turnaround time is so great that the product is consumed before the results of an analysis are known. If a contract laboratory is chosen, analysis time should be given consideration during negotiations to ensure an effective program. Because of the hazardous nature of fuels, transportation can be difficult and costly and should be factored into the decision. A state-owned laboratory should be assured the proper resources, e.g., a full staff and well maintained instruments, to be able to meet satisfactory turnaround time.

Laboratory Facility

A testing laboratory requires a unique building designed to accommodate laboratory instruments ranging from a delicate gas chromatograph to octane engines capable of producing severe vibrations. In addition, extremely flammable liquids will be stored and tested throughout the facility. Obviously, the facility design must minimize the chances for explosion and fire and also be capable of withstanding the forces of an explosion. National Fire Protection Association (NFPA) 45, "Standard on Fire Protection for Laboratories Using Chemicals," should be reviewed with contractors to ensure minimum standards are met.

The actual design of the laboratory is dependant upon the products which will be tested. For example, if the octane or cetane number is to be determined, special considerations must be made for foundation and utilities.

Special considerations should be given to the following:

1. Sufficient ventilation to ensure workers are not unduly exposed to gasoline fumes and other toxic vapors.

2. Fume hoods and exhaust systems in laboratory areas.

3. Drain lines resistant to acid and petroleum products.

4. Traps to prevent petroleum products from entering the sewer system.

5. Special foundations for ASTM/Cooperative Fuel Research Committee (CFR) engines. It is recommended that sufficient foundations for future expansion be installed during initial construction.

6. Necessary safety equipment, such as fire blankets, fire extinguisher, eyewash stations, etc.

7. Automatic fire extinguishing system for laboratory areas. The extinguishing system's design should include considerations regarding the susceptibility of laboratory instruments to damage when exposed to water or dry chemicals.

8. An adequate heating, ventilation, and air conditioning (HVAC) system to handle excess heat generated by distillation instruments and octane engines.

9. A properly designed and sized electrical system.

10. The laboratory's design to ensure all fuel testing can be performed in accordance with ASTM requirements. Volume 05.04 of the Annual Book of ASTM Standards contains valuable information regarding the design of a knock-testing laboratory.

11. Automatic hydrocarbon monitors to warn of critical accumulation of explosive vapors.

Several fixed equipment items are necessary for the laboratory's operation, including:

1. Air compressor, vacuum pump and piping of sufficient size to supply the entire laboratory's needs.

2. Gas and water piped to all areas of the laboratory.

3. Storage area for retained evidence, reference fuel and excess fuel and lubricant after analysis. Depending on the number of samples, this may consist of a properly ventilated storage area with locking storage cabinets and 208 L (55 gal) drums, to a flammable storage room and several 1892 L (500 –gal) storage tanks. (Larger tanks may be needed if they are to supplement the program's vehicle's needs.)

The size of the laboratory will depend upon the products tested and the estimated sample flow. The following space listing is for a small laboratory capable of testing approximately 6000 fuel samples per year. Some space requirements, such as those for octane testing, may seem large, but it is strongly recommended that two additional engine foundations be installed during initial construction.

1. Office, bathroom facilities, conference room, etc. (as required). No space requirements are listed as this must be determined by the user based on program needs and local building codes.

2. Octane laboratory–designed for four engines (75 m^2 [750 ft^2]).

3. General laboratory (70 m^2 [750 ft^2]).

4. Distillation laboratory (37 m^2 [400 ft^2]).

5. Shipping and receiving (includes preparation area for empty sample containers) (37 m^2 [400 ft^2]).

6. Flash point laboratory (19 m^2 [200 ft^2]).

7. Shop area (23 m^2 [225 ft^2]).

8. Storage for supplies (23 m^2 [225 ft^2]).

9. Secured, cooled, and ventilated sample and flammable storage area (23 m^2 [225 ft^2]). (Insulation and a dedicated ventilation and cooling system should be considered for this room.)

Total square footage (exclusive of item 1) – 30 m^2 (3225 ft^2). Including offices, bathroom facilities, hallways, etc., the total building size may exceed 372 m^2 (4000 ft^2). It is not necessary to isolate each testing operation into separate laboratories. However, because of the noise generated, it is recommended that the test engines (octane and cetane) be placed in a separate room.

If lubricant testing is to be performed, the size of the general laboratory will need to be increased. The amount of increase is dependant upon the tests which will be performed. However, if work is limited to viscosity measurement, an additional 37 m^2 (400 ft^2) should be sufficient.

Tests and ASTM Test Procedures

Careful consideration should be given to the selection of laboratory test procedures since these selections will affect instrument costs, number of personnel, timeliness of samples, and confidence in results. As previously mentioned, ASTM and SAE specifications and test methods are universally recognized standards for fuels and lubricants and should be the primary choice for test procedures. The ASTM Subcommittee D 02 on Petroleum Products and Lubricants is responsible for developing specifications and test procedures and is generally comprised of representatives from the petroleum industry, automotive manufacturers, and regulating agencies. This representation ensures that test procedures have been reviewed by each segment of the testing community and laboratory results obtained utilizing these procedures will be widely accepted.

New instrumental methods are often introduced to facilitate testing. Chemical methods have been devised to replace or screen physical methods which may enhance efficiency by reducing staff or analysis time necessary to perform physical methods. These methods are normally devised for a controlled environment, such as a processing plant, where physical parameters may be drawn with confidence. A new laboratory is cautioned to refrain from investing in this instrumentation and the laboratory expertise necessary to perform the test procedures until they are approved by ASTM. Screening methods have been employed by State laboratories to maintain or increase sample coverage. Screening procedures are a deviation of accepted ASTM procedures; certain sections of a procedure may be excluded or modified, such as chilling a sample to the appropriate temperature or accurately timing a distillation analysis. When a screen sample exceeds a predetermined parameter, the sample is analyzed using the proper ASTM procedure. Screening should be discouraged as a means to increase sample coverage. Strategies, such as selective sampling and testing, should be employed as a means for effective regulation.

Following are references to ASTM and SAE specifications and testing procedures which form an effective nucleus for a testing laboratory with regulatory responsibilities. ASTM test methods listed here do not necessarily exclude other ASTM procedures that are designed for the purpose and that give comparable results. The significance of each of these analyses is included in the ASTM specifications. Some of the test procedures listed make provisions to allow the use of automated equipment. Such equipment is usually more expensive. However, the increased cost can be recovered in a high production lab by reduced labor costs. The asterisks after test methods indicate a preferred method due to cost or ease of implementation.

Spark Ignition Engine Fuel Specifications – D 4814

1.	Distillation	D 86
2.	Octane (Antiknock Index)	
	Research	D 2699
	Motor	D 2700

3. Vapor Pressure

Dry Method	D 4953
Automatic Method	D 5190*
Mini Method	D 5191*
Mini Method - Atmospheric	D 5482*

4. Oxygenate Content

GC with TC or FID	D 4815
GC with OFID	D 5599
Infrared Spectroscopy	D 5845

5. Sulfur Content (Due to environmental law and regulations, the sulfur limits shown in D 4814 may be significantly higher than specified. The detection limit and precision of each method should be considered when selecting a test method.)

X-Ray Spectrometry	D 2622
Microcoulometry	D 3120
Ultraviolet Fluorescence	D 5453

6. Water Tolerance D 6422

7. Workmanship D 4814

Diesel Fuel Specifications – D 975

1. Flash Point D 93

2. Distillation D 86

3. Sulfur Content (The appropriate test method is dependent upon the grade. The forthcoming reduction in sulfur content by EPA starting in June, 2006, will require equipment with lower detection limits and better precision.)

X-Ray Spectrometry	D 2622
Microcoulometry	D 3120
X-Ray Fluorescence	D 4294

4. Cloud Point

Manual Method	D 2500
Stepped Cooling (Automatic)	D 5771
Linear Cooling Rate (Automatic)	D 5772
Constant Cooling Rate (Automatic)	D 5773

5. Water and Sediment D 2709

6. Cetane D 613

7. Lubricity D 6079

Kerosene Specifications – D 3699

1. Flash Point D 56

2. Distillation D 86

3. Sulfur Content

X-Ray Spectrometry	D 2622
X-Ray Fluorescence	D 4294*
Ultraviolet Fluorescence	D 5453

4. Color D 156

5. Water and Sediment D 1796

Aviation Turbine Fuel - D 1655

1. Flash Point D 56
2. Distillation D 86
3. Water Reaction D 1094
4. Freeze Point D 2386

Motor Oil – SAE J300

1. Kinematic Viscosity D 445
2. Cold Cranking Simulator D 5293

Gear Oil – SAE J306

1. Kinematic Viscosity D 445
2. Brookfield Viscosity D 2983

Automatic Transmission Fluid

1. Kinematic Viscosity D 445
2. Brookfield Viscosity D 2983

Laboratory Equipment and Supplies

Scientific instrumentation is typically more expensive than initially anticipated even when one has experience purchasing equipment. ASTM has approved methods utilizing automated instruments which may prove to be a better long-term investment when the cost of operating personnel is included. The costs of equipment and supplies change, therefore, providing estimates in this document would be of little value. Because of the relatively small demand for laboratory equipment, it is common to have only one source. However, when possible, obtaining competitive bids can reduce costs. Purchasing used equipment from other labs or vendors can provide a source of equipment at reduced costs.

Information Management System

No recommendations are made for an information management system. However, it should be noted that an information management system is an effective tool to manage data and statistical information when devising sampling strategies and when measuring the general effectiveness of a program.

Minimum requirements for an information management system include a database server and database adequate to handle sample biographical and analyses information. A means to network technicians and staff to the information is necessary to facilitate transfer of information. Considerations for software security and equipment security (limited access to the database server) should be given to ensure the integrity of the data.

Many departments have established information management centers which are consulted for this information. Generally, these departments have a particular protocol for developing information management systems.

Office Equipment and Supplies

No listing is given since needs are determined by the program's scope. However, the costs of items such as desks, filing cabinets, computers, forms, and miscellaneous office supplies must be considered when planning an initial budget.

Quality Assurance/Quality Control

The previous sections have addressed structural aspects of an engine fuels testing laboratory: building requirements, testing procedures, and analytical instruments. The management system for a laboratory is as unique as the structural requirements. Quality assurance/quality control programs were originally devised to give statistical verification of analytical results; however, they are now evolving to become the standard management model for laboratories. Chain of custody procedures, sample retention procedures, sample distribution procedures, and documentation of each step has been integrated into the quality assurance program.

ASTM has developed two documents which provide quality assurance guidelines for a petroleum laboratory. They are ASTM D 6792, Quality System in Petroleum Products and Lubricants Testing Laboratories and ASTM D 6299, Applying Statistical Quality Assurance Techniques to Evaluate Analytical Measurement System Performance. The first document, D 6792, provides a guide to the essential aspects of a quality assurance program. It includes such issues as sample management, record management, accurate test data, proficiency testing, corrective actions, and training. The second document, D 6299, describes in great detail methods to assure test precision and accuracy.

Another source of information in establishing a quality assurance program is the International Organization for Standardization (ISO) model quality assurance program, ISO 9000. There is no accreditation program specifically for State testing laboratories, and ISO 9000 accreditation is currently quite expensive; however, the ISO 9000 is an excellent model to use in developing a management system.

One excellent method to evaluate the performance of a laboratory is to compare the results obtained with other laboratories. ASTM has developed an Interlaboratory Crosscheck Program to achieve this goal. Samples are periodically sent to participating labs for analysis. The results are submitted to the summarizer and statically compared to other participating laboratories. The summarized results are then compared to the published precision statements. Coded summary reports (to maintain confidentiality) are sent to each participant. The program includes automatic transmission fluid, aviation turbine fuel, engine oil, gear oil, gasoline and diesel fuel as well as other products.

ASTM operates a National Exchange Group (NEG) to distribute fuels among participating laboratories and provides a statistical report of the results. There are three subgroups of the NEG: the Motor Fuel Exchange Group, the Diesel Fuel Exchange Group, and the Aviation Gasoline Exchange Group. Of the three types of participation, only two will concern a state laboratory: a member laboratory receives monthly samples and agrees to participate in special method research; and a "quarterly participant" receives two sets of samples every 3 months but is not bound to run special tests. The NEG will provide a means for assessment of quality at the national level. There are also regional groups which provide similar quality assessment exchange programs: Appalachian, Atlantic, Great Lakes, Mid-Continent, Northwest, Pacific Coast, Rocky Mountain, Texas Regional and LA Gulf Coast, Sabine, and Texas City-Houston Subgroups.

Safety Program

A laboratory can be an extremely hazardous work environment, so safety must be integrated into all operations of a laboratory. The Occupational Safety and Health Administration (OSHA) established a requirement effective January 1, 1991, for laboratories to develop a Chemical Hygiene Plan (29 CRF 1910.1450). The guidelines for the Chemical Hygiene Plan were intentionally left general so that an organization's plan could be customized for unique situations in individual laboratories. The Chemical Hygiene Plan details an organization's responsibilities for safety training, supply and maintenance of safety equipment and personal protective equipment, monitoring employees' exposure level to hazardous chemicals, medical consultation and examination, and availability of documents addressing safety procedures and emergency response. The Chemical Hygiene Plan is required to be reviewed annually which provides a format to plan and track improvements.

Reference documents are an essential part of an effective safety program. Safety procedures should accompany and complement testing procedures to ensure an employee is performing functions in an acceptable manner. Emergency response manuals address hazardous or potentially hazardous situations. Proper procedures for handling large spills, evacuation of work areas, and employees who have been overexposed to hazardous materials are typically found in the emergency response manual. Material Safety Data Sheets (MSDS) contain pertinent information regarding the hazards of chemicals and the necessary precautions. These documents should be distributed to employees or located in an easily accessible location.

Coordination with local fire and hazmat (hazardous material) departments is essential to ensure rapid emergency response. A chemical inventory and a diagram of the laboratory space are often requested by these departments to expedite their response. Periodic review of the chemical inventory will ensure unnecessary chemicals will be disposed of in a timely manner.

The most effective safety tool is thorough training of employees. Each new employee should be trained with the Chemical Hygiene Plan, safety procedures, emergency response manual, and MSDS's. Subsequent review sessions should be scheduled to ensure familiarity of individual responsibilities and actions. Educational videos are available specifically addressing laboratory safety which can assist in the training process. Hands-on training should be utilized to demonstrate the proper use of fire extinguishers, fire blankets, and other safety equipment in the laboratory. An effective safety program will produce aware employees who can suggest enhancements to the safety of the laboratory.

Personal safety equipment should be provided to all laboratory personnel. Eye protection, lab coats/aprons, and gloves will provide minimum protections. If the use of a fume hood is not practical and an employee is exposed to petroleum or chemical fumes, organic respirators should be provided to minimize exposure. Determination of which equipment is necessary for handling particular chemicals can be found in the MSDS accompanying the chemicals.

General laboratory safety equipment should be considered during the design or selection of a building. In addition to a good ventilation system, fume hoods should be provided where practical to isolate fumes from the laboratory. Due to the explosive nature of gasoline, even safety equipment needs to be evaluated for safety; for example, explosion-proof motors should be installed to evacuate fumes from a hood. Eyewash stations, fire extinguishers, emergency shower, and fire blankets should all be placed strategically for maximum protection.

In the event of a spill, several safety items will prove useful. Activated charcoal, sold under a variety of names, is effective for absorbing small petroleum spills with the added benefit of quickly reducing vaporization. Other companies offer pads to quickly absorb spills. Similar products are offered to neutralize and absorb acids and bases. Safety signs should be posted at the entrance of each laboratory room listing possible hazards and restricted activities (e.g., No Smoking, Flammables, Eye Protection Required, etc.). These signs assist visitors and emergency response personnel to identify hazards quickly.

Hazardous Waste

Testing laboratories generate quantities of hazardous waste. Waste chemicals from various analyses and residual samples must be stored and disposed in an appropriate manner. The majority of regulations for storage, disposal, and documentation of hazardous materials may be found in EPA's SARA Title III, 40 CFR 1500. Additional regulations and permits may be required by State, county or municipal agencies. Familiarity with the regulations will be advantageous when considering the design of the laboratory. Specific expenses related to hazardous waste disposal will often be determined by local regulations and the availability of hazardous waste handlers. Some companies provide disposal services which recycle products. This type of service is usually less expensive and provides protection from future "cradle to grave" liabilities. Therefore, waste materials should be segregated to take advantage of recycling services.

Personnel

The staffing requirements for a testing laboratory will be dependent on the number of samples, the number of tests performed on the samples, and the testing instruments chosen. The staff recommended here will be suitable for a fuels testing laboratory with moderate automation (auto-sampler for the gas chromatograph, automated RVP instrument, etc.) running approximately 6000 to 8000 samples per year.

1 Laboratory Administrator

2 Chemists

2 CFR Engine Operators

2 Laboratory Technicians

1 Clerk

The laboratory administrator should have strong management skills and familiarity with laboratory operations and chemical techniques. The administrator's responsibilities include the development and implementation of the quality assurance program, safety program, and hazardous waste program, as well as providing guidance for the daily operation of the laboratory.

The chemists should have a strong chemistry background and familiarity with instrumental techniques. In addition to normal analytical responsibilities, chemists should assist with the review of analytical results by technicians. Chemists also can assist in the development and implementation of the quality assurance, safety, and hazardous waste programs.

The engine operators are the most difficult positions to fill. The ideal operator will have petrochemical experience with a mechanic's background since the majority of the engine maintenance will be performed by the operators. The petroleum industry estimates approximately 5 years of engine operation is necessary to develop an expertise. To expedite this process, engine operators should periodically attend training workshops and regional exchange group meetings. Laboratory technicians should have laboratory experience and a familiarity with scientific methods. Cross training of these individuals is an effective means of maintaining an even workflow through the laboratory.

Concluding Note

There is no better way to understand the complexities of testing than to visit a state with an active program. Several States, such as Arkansas, California, Florida, Georgia, Maryland, North Carolina, Missouri, Michigan, Washington and Tennessee (a contractual laboratory) have active programs and are willing to host tours of their facilities. Interested parties are encouraged to make such a visit.

References

John E. Nunemaker, "Planning Laboratories: A Step by Step Process" *American Laboratory*, March 1987, 19 (4), 104 - 112.

Jerry Koenigsberg, "Building a Safe Laboratory Environment" *American Laboratory*, June 1987, 19 (9), 96 - 106.